Pre-treatment Predictors of Dropout from Prolonged Exposure Therapy in Patients with Chronic Posttraumatic Stress Disorder and Comorbid Substance Use Disorders

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Abstract

Posttraumatic stress disorder (PTSD) and substance use disorders (SUDs) are commonly co-occurring disorders associated with more adverse consequences than PTSD alone. Prolonged exposure therapy (PE) is one of the most efficacious treatments for PTSD. However, among individuals with PTSD-SUD, 35–62% of individuals drop out of trauma-focused exposure treatments. Thus, it is important to identify predictors of PTSD treatment dropout among substance abusers with PTSD in order to gain information about adapting treatment strategies to enhance retention and outcomes. The current study explored pre-treatment predictors of early termination from PE treatment in a sample of 85 individuals receiving concurrent treatment for PTSD and a SUD in a residential treatment facility as part of a randomized controlled trial. The results indicated that less education and more anxiety sensitivity uniquely predicted PE treatment dropout. Demographic variables, PTSD severity, SUD severity, mental health comorbidities, and emotion regulation difficulties did not predict treatment dropout. These results suggest that adding pre-treatment interventions that address anxiety sensitivity, and promote social adjustment and cognitive flexibility, could possibly improve PE retention rates in clients with high anxiety or low education.

Keywords

prolonged exposure; dropout; treatment termination; posttraumatic stress; substance use

Posttraumatic stress disorder (PTSD) and substance use disorders (SUDs) are commonly co-occurring disorders. Among individuals seeking treatment for SUDs, approximately 36–50% will also have a lifetime PTSD diagnosis (Brady, Back, & Coffey, 2004). This is over five times greater than the U.S. lifetime prevalence rate for PTSD (Kessler, et al. 2005). Co-occurring PTSD in individuals diagnosed with a SUD is associated with a host of adverse outcomes, including more intense cravings, greater length of inpatient addiction treatment,

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quicker relapse, and higher suicide rates (Berenz & Coffey, 2012; Brown, Stout, & Mueller, 1999; McCauley, Kileen, Gros, Brady, & Back, 2012). Thus, treating PTSD symptoms may play an important role in breaking the cycle of continued substance use.

Prolonged exposure (PE) therapy is one of the most effective treatments for PTSD (Ballenger et al., 2000; Powers Halpern, Ferenschak, Gillihan, & Foa, 2010). Clinical trials have demonstrated that PE effectively reduced PTSD, depression, and SUD symptoms amongst those with comorbid PTSD and SUDs (hereafter PTSD-SUD; e.g., Brady, Dansky, Back, Foa, & Carroll, 2001; Coffey et al., 2016; Foa et al., 2013; Mills et al., 2012). Although exposure-based therapies have been shown to be effective for PTSD and PTSD-SUD, dropout rates are high. A recent meta-analysis estimated that 36% of individuals with PTSD drop out of exposure-based trauma treatments (Imel, Laska, Jakcupcak, & Simpson, 2013). Further evidence suggests that individuals with PTSD-SUD are particularly likely to drop out of exposure-based trauma treatment. In treatment trials, 35–62% of individuals with PTSD-SUD terminate trauma-focused exposure therapies prematurely (Brady et al., 2001; Coffey et al., 2016; Foa et al., 2013; Mills et al., 2012; Sannibale et al., 2013). Individuals in SUDs treatment are also more likely to terminate early if they have comorbid PTSD (McCauley et al., 2012). Thus, identifying predictors of early treatment termination among those with PTSD-SUD remains an important challenge.

Demographic and Socioeconomic Status Predictors

The previous literature has largely focused on demographic variables and clinical severity markers (i.e., PTSD severity and psychiatric comorbidity) to identify predictors of dropout from exposure-based treatment for PTSD. Importantly, these studies have predominantly been conducted in outpatient PTSD samples without a SUD, and data concerning dropout among those with PTSD-SUD are limited. Although findings have been mixed, studies focused on PTSD without a SUD have identified several demographic predictors of dropout, including male gender (van Minnen, Arntz, & Keijsers, 2002), female gender (Eftekhari et al., 2013), African American race (Lester, Artz, Resick, & Young-Xu, 2010), younger age (Jeffreys et al., 2014; Rizvi, Vogt, & Resick, 2009), less education (Rizvi et al., 2009), lower intelligence (Rizvi et al., 2009), and unemployment (Foa et al., 1999). Between the two studies that have examined factors linked to PE dropout within outpatient PTSD-SUD samples (Zandberg, Rosenfield, Alpert, McLean, & Foa; Brady, Dansky, Back, Foa, & Carroll, 2001), one found education to be associated with treatment dropout (Brady et al., 2001). Given the limited research on predictors of treatment dropout within PTSD-SUD samples and the focus on largely outpatient samples, it will be important to examine these predictors within PTSD-SUD samples as well as expand into different treatment settings (e.g., residential, inpatient).

Clinical Severity Predictors of Dropout from Exposure-Based Therapies for PTSD

Research on clinical severity markers predicting dropout has also shown inconsistent results. Two studies conducted in PTSD outpatient samples have found that baseline PTSD severity was significantly greater among participants who dropped out of trauma-focused treatment

for PTSD compared to the participants who did complete treatment (Marks, Lovell, Noshirvani, Livanou, & Thrasher, 1998; Zayfert et al., 2005). Other studies within PTSD outpatient samples have failed to find this association (Eftekhari et al., 2013; Rizvi et al., 2009; Taylor, 2003; van Minnen et al., 2002). Of the limited research in PTSD-SUD samples, no significant association between baseline PTSD severity or SUD severity and PE treatment dropout has been found (Brady et al, 2001; Zandberg et al., 2016). Studies examining psychiatric comorbidity as a predictor of dropout have also yielded mixed results. In a PTSD outpatient sample, Markowitz and colleagues (2015) recently found that individuals who had a co-occurring major depressive disorder were nine times more likely to drop out of PE treatment for PTSD. However, other PTSD outpatient studies have found no association between depressive symptomology or other psychiatric comorbidity and PE treatment dropout (Brady et al., 2001; Eftekhari et al., 2013; Rizvi et al., 2009; Taylor, 2003; van Minnen et al., 2002; Zandberg et al., 2016). Additionally, the studies examining PTSD-SUD samples have failed to find additional anxiety or depressive symptoms to be associated with PE treatment dropout (Brady et al., 2001; Zandberg et al., 2016). Because of the scarce research in PTSD-SUD samples, along with some evidence for a potential link between clinical severity markers and dropout from PTSD treatment, it will be important to understand if clinical severity plays a role in treatment dropout amongst those with PTSD-SUD.

Individual Differences in Reactions to Internal Experiences

Given the mixed literature on demographic and clinical severity variables as predictors of dropout, it may be more fruitful to explore characteristics that relate specifically to exposure-based treatments. In exposure-based treatment, the patient is asked to tolerate and manage aversive internal experiences such as anxiety, fear, disgust, and horror. It is possible that individual differences in reactions to such experiences play an important role in early termination from exposure-based treatments. For example, anxiety sensitivity is a trait-like cognitive vulnerability that involves the fear of anxiety-related bodily sensations and their potential physical, cognitive, and social consequences (Reiss, Peterson, Gursky, & McNally, 1986). Heightened anxiety sensitivity may increase discomfort and distress associated with exposure exercises and promote dropout from treatment. Two studies in outpatient PTSD (Taylor, 2003) and PTSD-SUD (Zandberg et al., 2016) samples failed to find significant associations between anxiety sensitivity and drop out from PE. However, in a sample presumably more severe than typical outpatient samples, Lejuez and colleagues (2008) have shown that greater anxiety sensitivity predicts dropout from residential SUD treatment even after controlling for demographic variables, other drug variables, legal obligation to treatment, alcohol use frequency, and depressive symptoms. This suggests that anxiety sensitivity may be a particularly important predictor of treatment dropout among more clinically severe patients.

Emotion regulation difficulties may also increase discomfort with exposure exercises and promote early treatment termination. Difficulties in adaptively regulating emotions has been conceptualized by Gratz and Roemer (2004) as reflecting several dimensions, including a lack of emotional awareness, lack of emotional clarity, difficulties controlling impulsive behaviors and engaging in goal directed behavior when distressed, non-acceptance of

negative emotional experiences, and limited access to effective emotion regulation strategies. Cloitre and colleagues (2010) found that interpersonal and emotion regulation skills training prior to exposure-based interventions for PTSD decreased treatment dropout among females with PTSD related to childhood abuse. However, it is not clear if the training reduced dropout by promoting interpersonal functioning or by addressing emotion regulation difficulties per se.

The Current Study

The aim of the current study was to examine pre-treatment predictors of dropout from PE in a sample of individuals receiving concurrent residential SUD and PTSD treatment in a randomized control trial. To our knowledge, only two studies have compared treatment completers and noncompleters within a PTSD-SUD sample receiving concurrent SUD and exposure-based PTSD treatment (Brady et al., 2001; Zandberg et al., 2016). However, these studies were conducted within outpatient samples of individuals reporting mild to moderately severe PTSD (Brady et al., 2001; Zandberg et al., 2016). Additionally, Zandberg and colleagues (2016) sample consisted of alcohol dependent individuals without additional current substance dependence beyond nicotine and cannabis. The current study examined pre-treatment predictors within a more clinically severe PTSD-SUD sample receiving more intensive treatment than in prior studies. Given the mixed literature on demographic and clinical severity markers as predictors of treatment, we did not make specific predictions about these variables. We predicted, however, that higher levels of anxiety sensitivity and emotion regulation difficulties would be associated with dropout from PE because PE requires patients to tolerate aversive internal experiences.

Methods

Participants

Participants were recruited from a residential substance abuse treatment facility. A total of 835 patients were provided a brief description of the study from study personnel during their first week of substance use treatment. The 700 patients that expressed interest completed the pre-screening (see below) to determine initial eligibility. Of those 700, 238 were eligible to complete the assessment. An Institutional Review Board approved the study protocol. All participants provided written informed consent prior to enrollment in the study. A total of 222 individuals provided informed consent and were assessed accordingly.

Participants were included in the study if they met DSM-IV diagnostic criteria for alcohol dependence and PTSD related to a non-combat trauma. Participants were required to be between the ages of 18–64 and had to have at least one heavy drinking day in the past 60 days. Heavy drinking was defined as the consumption of four standard drinks for women and five standard drinks for men. Exclusion criteria included acute psychotic disorder, active manic episode, imminent suicide risk, a medical condition that could compromise participation in treatment, current use of benzodiazepines, or medications for craving or alcohol use. Participants were also excluded if they were illiterate in English or were in an ongoing abusive relationship and trauma from this relationship was the focus of treatment.

Of these 222 individuals, 66 participants were deemed ineligible to participate (n = 53 no PTSD diagnosis, n= 6 no ETOH diagnosis, n = 2 no PTSD or ETOH diagnosis, n = 4 cognitive impairment/psychosis, n = 1 due to a medical condition), 5 left the treatment facility, 7 participants were eligible but refused to participate, and 18 did not participate for other non-specified reasons. The final intent-to-treat sample consisted of 126 individuals, with 45 randomized to a modified PE, 40 randomized to a modified version of PE plus a pre-PE 90-minute trauma-focused motivational enhancement therapy (MET-PTSD), and 41 to a health information control condition. Participants who completed all assessment sessions in person (baseline, 3-month, 6-month follow-ups) were compensated with a $355 check. However, participants who completed only the baseline assessment session in person and the three-month and six-month follow-ups via telephone received a $295 check. Study treatment sessions were not compensated. In addition, consistent with intent to treat approach, participants who discontinued a study treatment were allowed to participate in follow-up assessments.

Measures

Pre-Screening Measures—Prospective participants completed the *PTSD Checklist (*PCL; Weathers, Litz, Herman, Huska, & Keane, 1993), a well-validated measure of DSM-IV-TR PTSD symptom severity, designed to assess for likelihood of meeting diagnostic criteria for PTSD. Additionally, the *Alcohol Use Disorder Identification Test* (AUDIT; Saunders, Aasland, Babor, de la Fuente, & Grant, 1993) was administered to determine presence of problematic drinking.

Clinical Interviews—PTSD diagnostic status and symptom severity was assessed with the Clinician-Administered PTSD Scale (CAPS; Blake et al., 1995). This clinician-rated semi-structured interview is designed to assess each of the 17 symptoms of PTSD according to the DSM-IV-TR (APA, 2000). Both frequency and severity ratings range from 0–4. A symptom was considered present if it had a frequency rating of at least a 1 and a severity rating of at least a 2. (Weathers, Keane, & Davidson, 2001). A total severity score is calculated by summing the frequency and severity ratings of the 17 symptoms (range 0–136). The CAPS has demonstrated excellent internal consistency and inter-rater reliability (Weathers et al., 2001). For the purposes of this study, the pre-treatment CAPS total score was used. The CAPS were audiotaped and senior research personnel reviewed the first five audiotapes. In this current study, the level of diagnostic agreement for a random sample of the CAPS (about 20% of all interviews) was high (*kappa* = .94).

Substance use disorder diagnostic status was assessed with the Computerized Diagnostic Interview Schedule (C-DIS; Robins et al., 2000), according to DSM-IV-TR criteria. Additionally, the Mini-International Neuropsychiatric Interview (MINI; Sheehan et al., 1998) was used to assess pre-treatment DSM-IV-TR Axis I mood and anxiety disorders other than PTSD, as well as to determine exclusion criteria.

The Timeline Follow-Back Interview (TLFB) assesses the amount of alcohol and drugs consumed within a specific period using a calendar method (Sobell & Sobell, 1992). The

current study used the TLFB to assess the number of days drinking and using drugs within the past 90-days prior to entering treatment.

Self-Report Measures—The Alcohol Craving Questionnaire-Now (ACQ-Now; Singleton, Tiffany, & Henningfield, 1994) is a 47 item self-report measure of craving in the present moment. The ACQ–Now has strong psychometric properties (Connolly, Coffey, Baschnagel, Drobes, & Saladin, 2009). The ACQ-Now demonstrated excellent internal consistency ($a = .97$) in the current study.

The Anxiety Sensitivity Index (ASI; Reiss et al., 1986) is a 16-item self-report measure of fear of negative outcomes resulting from physiological sensations and cognitions related to anxiety (e.g., shortness of breath and racing heart). The ASI is widely used, with good predictive validity and test-retest reliability (Peterson & Reiss, 1992; Reiss et al., 1986). The ASI total score was used in the analyses and demonstrated good internal consistency ($a = .89$).

Emotion dysregulation was assessed with the Difficulties in Emotion Regulation Scale (DERS; Gratz & Roemer, 2004). This 36-item self-report measure assesses perceived ability to regulate emotion, emotional awareness and understanding, acceptance of emotional responses, impulse control, and interference of emotion dysregulation with activities. The DERS has demonstrated good test-retest reliability, internal consistency, and construct validity (Gratz & Roemer, 2004; Ritschel, Tone, Schoemann, & Lim, 2015). For this study, the DERS total score was used and had excellent internal consistency ($a = .91$).

The Beck Depression Inventory-II (BDI-II; Beck, Steer, & Brown, 1996) was used to assess depression severity, with higher scores indicative of more severe depression severity. This 21-item measure has demonstrated sound psychometric properties, including excellent internal consistency and test-retest reliability reported (e.g., Beck et al., 1996). Internal consistency of the BDI-II in this study was $a = .91$.

Procedures

Interested individuals first completed an initial in-person screening to determine likelihood of meeting diagnostic criteria for PTSD and alcohol dependence. Individuals who scored 44 on the PCL (Weathers et al., 1993) and 8 on the AUDIT (Saunders et al., 1993) provided informed consent and were scheduled to complete a comprehensive in-person assessment. Trained research staff conducted the comprehensive assessments.

Eligible participants meeting diagnostic criteria for PTSD and alcohol dependence based on the comprehensive assessment were randomly assigned to a modified version of PE, a modified version of PE plus a pre-PE 90-minute trauma-focused motivational enhancement therapy (MET-PTSD) session, or a control condition using urn randomization (Wei, 1978). The urn included sex, alcohol abuse symptom severity, PTSD symptom severity, and motivation to address trauma issues. Trained graduate students, postdoctoral fellows, and licensed psychologists provided the therapy. Irrespective of therapy condition, participants received one to two therapy sessions a week over the course of 5–8 weeks. Data analyses for

the current study are restricted to participants assigned to PE or PE plus a MET-PTSD session.

Treatment

Modified prolonged exposure (PE)—PE is a manualized, evidence-based cognitive behavioral therapy that is designed to reduce PTSD symptoms through use of imaginal and *in vivo* exposure techniques (Foa, Hembree, & Rothbaum, 2007). Consistent with Foa and colleagues (2005), participants in this study were offered 9–12 sessions of modified PE that included PTSD psychoeducation, a rationale for PE, breathing retraining, and imaginal and *in vivo* exposures. Participants listened to their audiotaped imaginal exposures daily, in addition to completing out-of-session *in vivo* exposures. Nine sessions of modified PE were initially offered to each participant, with 3 additional sessions offered if PTSD symptom scores had not decreased by a minimum of 70% by session 8 (Foa et al., 2005). The treatment sessions were administered sequentially. If a participant missed a session, the session was rescheduled. Thus, there were no missing mid-treatment sessions with attendance at later sessions.

Several adaptations were made to conventional PE in this study. Namely, sessions were 60 minutes in duration rather than 90 minutes. This modification was made in order to enhance dissemination of prolonged exposure within a substance use residential facility, where 90-minute sessions may not be feasible. Clinical trials have suggested that 60-minute sessions promote similar reductions in PTSD symptoms as 90-minute sessions (Nacash et al., 2015; van Minnen & Foa, 2006). Also, psychoeducation was included pertaining to the relationship between PTSD and substance use disorder symptoms, and a weekly check-in was incorporated regarding progress in SUD treatment. Additionally, in an attempt to enhance retention rates, approximately one half of participants who received modified PE were provided with a 90-minute session of MET for PTSD prior to beginning modified PE, while the other half of participants completed a 60-minute relaxation session. MET-PTSD was designed to resolve ambivalence about engaging in PTSD treatment and evoke patient motivation to address trauma.

Substance use disorder treatment—All participants received treatment-as-usual (TAU) for SUDs. Treatment comprised AA and NA meetings, approximately 3 hours of daily group therapy, daily recreational therapy, and individual counseling sessions related to substance use and associated homework. Addictions counselors unaffiliated with the study provided TAU over the course of 6 weeks.

Data Analysis

The focus of this study was to identify predictors of dropout from modified PE. Therefore, participants randomized to the control condition were not included in the analyses. As published in the main RCT paper (Coffey et al., 2016), logistical analyses revealed no differences in dropout rates between PE and PE+MET-PTSD ($B = -.094$, $p = .834$). Additionally, multilevel mixed effect models revealed no significant differences between PE and PE+MET-PTSD on PTSD and SUD outcomes (all $p > .40$). Therefore, the modified PE and modified PE + MET-PTSD conditions were collapsed for these analyses.

The Fournier approach (Fournier et al., 2009; Zandberg et al., 2016) was used to identify potential demographic, socioeconomic status, mental health severity, and substance use severity predictors of early termination from modified PE. With this approach, related predictors are grouped into domains. Then, significant predictors from each domain are entered into a final model. This approach permits the examination of a large number of predictors while managing a balance between Type I and Type II error. Analyses were conducted using logistical regression, with the dropout group serving as the criterion and the completer group serving as the reference group. Clinical trials typically define dropouts as those who do not complete the full course of recommended treatment (Imel et al., 2013) and PE is typically conducted over 8–15 sessions (Foa et al., 2011), with many studies categorizing patients that have attended less than 8 sessions as a treatment dropout (e.g., Bryant et.al., 2008; Foa et al., 2005; Wells, Walton, Novell, & Proctor, 2015). Therefore, for this study, participants that attended less than eight therapy sessions were considered dropouts.

Prospective predictors commonly examined in the dropout literature were grouped into four domains: 1) demographics (age, gender, white versus minority race), 2) socioeconomic status (education (with categorical variables: did not complete high school, completed high school, completed some post-secondary education/college, completed 4 year college degree and beyond), household income (continuous variable rounded to nearest thousand), employment (employed versus unemployed) , 3) mental health severity (number of additional anxiety and depressive disorders, baseline PTSD symptom severity, baseline depressive symptom severity), and 4) SUDs severity (baseline number of days drinking within the ninety days prior to treatment, baseline number of days using drugs within the ninety days prior to treatment, baseline alcohol craving levels).

The Fournier procedure was completed for each domain as follows: In Step 1, all potential predictors within the domain were included in the logistic regression analyses. Step 2 included only predictors with a significant level of $p < 0.20$ in Step 1. Step 3 included only tested variables from Step 2 that had a significance level of $p < 0.10$. Step 4 included only tested significant variables from Step 3 that had a significance level of $p < 0.05$. The variables that were significant at Step 4 from each domain were included in a final model. Within the initial and final models as well as the tests of multicollinearity, education was modeled as a set of indicator variables, with those that "did not complete high school" serving as the reference group.

Given our interest in examining variables that are more closely linked to exposure-based therapies, we examined whether ASI and/or DERS contributed to the model after accounting for relevant demographic and clinical severity variables identified in the Fournier procedure.

Results

Participant Characteristics

Of the 85 participants assigned to modified PE, 56.5% were males and 43.5% female. The mean age of the sample was 34.54 ($SD = 10.42$) years of age. The sample was 77.6% White, 20.0% Black/African American, and 2.4% other race/ethnicity. The majority of the sample

was unemployed (71.8%), with a median household income of $25,000. With respect to education, 11.8% had not completed high school, 24.7% completed high school, 50.6% completed some post-secondary education/college and 12.9% graduated with a four-year college degree or beyond. Participants had a mean CAPS score of 74.82 (17.27), which falls in the severe range of PTSD symptoms (Weathers et al., 2001). The majority of participants' were diagnosed with at least one additional current anxiety/depressive disorder (95.3%) and SUD (83.5%). Baseline participant characteristics can be found in Table 1. Thirty-three (38.8%) participants dropped out of treatment. Participants that dropped out completed a median of 5 sessions (Range: 1–7; $M = 4.67$, $SD = 2.04$).

Tests of Multicollinearity between Predictors

In order to investigate potential issues associated with multicollinearity amongst predictors, we examined both tolerance and the variance inflation factor (VIF) for each predictor. A predictor with a tolerance of less than .10, and a VIF of greater than 10, is thought to be problematic (Mason, Gunst, & Hess, 1989; Menard, 1995). All of the predictors in the current study had a tolerance between .338 and .859 and a VIF between 1.165 and 2.958. Therefore, our predictors passed multicollinearity diagnostic checks.

Predictors of Early Termination of PE for PTSD within Each Domain

Table 2 shows Steps 1 through 4 of the Fournier procedure. None of the demographic (all $p > .300$) or mental health severity variables (all $p > .600$) survived Step 4 of the Fournier procedure. In the socioeconomic status domain, education was a significant predictor of dropout ($p = .031$). Specific differences between different education groups are discussed below. Of the substance use severity variables, only the number of baseline days using drugs survived Step 4, with greater number of baseline days using drugs predicting dropout ($p = .044$).

Significant Predictors in the Final Model

Demographic and clinical severity variables surviving Step 4 of the Fournier procedure (education, baseline days using drugs), along with ASI and DERS were placed into the final model. The final model was significant, $\chi^2 (6) = 19.653$, $p = .003$. The model correctly predicted 75.3% of the sample (86.5% of completers, 57.6% of dropouts), with a Nagelkerke's R^2 of .280. Education was a significant predictor of dropout ($p = .029$). Participants who did not complete a high school education had higher dropout rates (70.0%) than those who completed some college (32.6%, $B = -2.219$, $p = .015$) as well as those who completed four years of college and beyond (9.1%, $B = -3.181$, $p = .018$). There were no significant dropout rate differences between those who did not complete high school with those who did (52.4%, $p = .157$). Higher ASI levels were also a significant predictor of dropout ($B = .050$, $p = .042$). There was a trend for greater number of baseline days using drugs as a predictor of PE dropout ($B = .016$, $p = .066$). DERS scores were not a significant predictor of dropout ($B = -.011$, $p = .425$).

Discussion

The aim of the current study was to identify predictors of treatment dropout in a sample of individuals receiving modified PE for PTSD and concurrent SUD treatment within a residential treatment setting as part of a randomized controlled trial. In our sample, less education was the only demographic variable that predicted dropout after other variables were accounted for. Specifically, those with less than a high school education were more likely to drop out compared to those who completed at least some college as well as those who completed college or post-college work. Also, with the exception of a non-significant trend for greater baseline days using drugs predicting dropout, none of the severity markers (e.g., PTSD severity, SUD severity, comorbidity) predicted early termination from treatment. With respect to individual differences in tolerating or managing aversive internal experiences, we found that heightened anxiety sensitivity, but not emotion regulation difficulties, significantly predicted early termination from PE. Overall, the findings suggest that low education and heightened anxiety sensitivity are both unique predictors of dropout from PE among individuals with PTSD-SUD.

The negative effect of low education on treatment retention has been reported in previous studies with PTSD (Rizvi et al., 2009) and PTSD-SUD populations (Brady et al., 2001). Our study, however, employed less stringent inclusionary criteria (i.e., all dually diagnosed patients) and examined a patient population that is more severely impaired (i.e., residential patients) compared with those in previous studies. Previous researchers have proposed differing underlying mechanisms linking education and treatment. Riggs and colleagues (2003) regarded education as a proxy of social adjustment, such as stable employment or dependable relationships. Thus, lower education suggested a diminished ability to adjust to practical and emotional difficulties associated with completing a treatment program. Rizvi and colleagues (2009), on the other hand, regarded education as a proxy of one's ability to learn new ways of thinking. Additionally, other studies have linked poorer education to having a chaotic childhood environment (Currie & Widom, 2010; Gould, Lavy & Paserman, 2011). Thus, patients may not have been provided the early supportive role modeling and structure needed to develop the mental set of persisting through challenges, such as academics or psychological treatment. Given accumulating support linking education and treatment dropout, future research should directly assess these constructs to determine if any of the proposed underlying mechanisms would mediate the relationship between low education and treatment dropout. If social adjustment or a chaotic childhood environment proves to be the mediator, providing more supports such as problem solving and/or case management to enhance the client's current quality of life might reduce treatment dropout. On the other hand, if one's ability to learn new ways of thinking is the mediator, an assessment of problematic cognitions and a brief cognitive-behavioral intervention targeting them might reduce treatment dropout.

Surprisingly, the results showed that emotion regulation difficulties, measured with the DERS did not predict early termination. In contrast, even after controlling for other variables heightened anxiety sensitivity added significantly to the prediction of dropout. This is consistent with a previous finding showing that anxiety sensitivity uniquely predicted treatment dropout from residential SUDs treatment (Lejuez et al., 2008). However, Taylor

(2003) and Zandberg and colleagues (2016) did not find an association between anxiety sensitivity and early termination from PE. A possible explanation for the discrepancy in findings is differences in clinical severity. The Zandberg and colleagues (2016) sample was an outpatient sample with lower PTSD severity, fewer SUD comorbidities, and lower average ASI scores than the current sample. Additionally, the Taylor (2003) sample was an outpatient PTSD sample with no SUD comorbidities. Thus, it remains possible that anxiety sensitivity only predicts dropout from treatment in more severe clinical populations.

In PE, patients are asked to repeatedly elicit aversive emotional experiences associated with their trauma. Patients with high levels of anxiety sensitivity may be more likely to terminate treatment early due to difficulties with managing aversive internal experiences and overcoming maladaptive beliefs about the consequences of these symptoms. It is possible that interventions designed to address anxiety sensitivity will be a powerful pre-treatment addition to PE when treating patients with high anxiety sensitivity. Some case reports as well as an uncontrolled pilot study have demonstrated some support that sessions devoted to interoceptive exposures designed to directly address the anxiety-related bodily sensations prior to conducting trauma-focused exposure therapy may enhance outcomes for those with PTSD and elevated anxiety sensitivity (Wald & Taylor, 2005, 2007; Wald, 2008). Interoceptive exposure involves repeated exposure to feared anxiety-related bodily sensations via innocuous exercises (e.g., hyperventilating for one minute). Through these exercises, the patient's anxiety sensitivity is reduced through the process of learning that these sensations are harmless and do not lead to hazardous consequences. An additional study comparing an anxiety sensitivity reduction intervention (psychoeducation and a brief interoceptive exposure exercise) to a control intervention in a sample of individuals with largely subclinical PTSD symptoms and elevated anxiety sensitivity, found that the anxiety sensitivity intervention led to anxiety-sensitivity mediated reductions in PTSD symptoms (Allan, Short, Albanese, Keough, & Schmidt, 2015). While these studies provide promising preliminary support for interoceptive interventions for the treatment of individuals with PTSD and elevated anxiety sensitivity levels, it is unknown whether treatment retention rates and outcomes exceed those of prolonged exposure as a stand-alone intervention.

Our study has notable strengths including a relatively large and well-characterized sample. However, there are some important limitations to consider. Our study was unable to address what mechanisms, such as social adjustment (Riggs, Rukstalis, Volpicelli, Kalmanson, & Foa, 2003), cognitive flexibility (Rizvi et al., 2009), or a chaotic home environment (Curie & Widom, 2010; Gould et al., 2011) may be underlying the relationship between education and early termination from PE. While education was related to income, a variable thought to be involved in social adjustment, the variance in income that did not overlap with education was not uniquely predictive of treatment termination. Additionally, employment, another indicator of social adjustment, was not related to education or treatment termination. The current study did not have a measure of cognitive flexibility, so we were unable to test this potential mechanism. With respect to a chaotic childhood home environment, we conducted an exploratory analysis examining relationships between education and childhood abuse. We did not find a significant relationship between education and child abuse. Future studies should include a more comprehensive examination of potential mechanisms underlying relationships between education and treatment dropout. Additionally, our study was unable

to address whether or not differences in treatment settings (residential vs. outpatient) versus clinical severity contributed to the importance of anxiety sensitivity in early treatment termination in our sample compared to other samples. Future studies would benefit from clarifying these relationships.

In summary, our study explored predictors of early PE treatment termination within a sample of individuals receiving concurrent residential treatment for PTSD-SUD as part of a randomized controlled trial. The results suggest that lower education and heightened anxiety sensitivity predict earlier treatment termination. Given that this study was the first to examine unique predictors of PE dropout in a sample of patients receiving concurrent PTSD-SUD within a residential setting, future work will be needed to replicate these findings. Additionally, given that PE is known to be one of the most effective treatments for PTSD, future work should focus on understanding ways to reduce risk for dropout from PE treatment to enhance retention rates and outcomes.

Acknowledgments

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Highlights

- Examined predictors of exposure treatment termination in those with PTSD and SUD

- Lower levels of education uniquely predicted earlier treatment termination

- Higher anxiety sensitivity uniquely predicted earlier treatment termination

Table 1

Baseline Participant Characteristics (n = 85)

Variables Within Each Domain	M(SD)\Number (%)
Demographics	
Age (M (SD))	34.54 (10.42)
Male Sex (Number (%))	48 (56.5%)
White Race (Number (%))	66 (77.6%)
Socioeconomic Status	
Did not complete high school (Number (%))	10 (11.8%)
Completed high school (Number (%))	21 (24.7%)
Completed some post-secondary education/college (Number (%))	43 (50.6%)
Completed four-year college degree or beyond (Number (%))	11 (12.9%)
Employed (Number (%))	24 (28.2%)
Income (Median)	$25,000
Mental Health Severity	
Beck Depression Inventory-II (BDI-II) (M (SD))	30.95 (11.00)
Clinician Administered PTSD Scale (CAPS) Score (M (SD))	74.82 (17.27)
Number of Current Additional Anxiety/Depressive Disorders (M (SD))	2.81 (1.36)
Substance Use Severity	
Alcohol Craving Questionnaire (ACQ)-Now (M (SD))	155.88 (65.54)
Number of Days Drinking (M (SD))	47.40 (27.84)
Number of Days Drugging (M (SD))	45.28 (31.34)
Difficulties with Managing Internal Experiences	
Anxiety Sensitivity Index (ASI) Scale (M (SD))	35.24 (13.14)
Difficulties in Emotion Regulation (DERS) (M (SD)	108.36 (23.01)

Table 2

Steps 1–4 Fournier Analysis of Predictors of Treatment Dropout

Predictor	B	Wald Statistic	p	OR	95% CI
Step1					
Demographics					
Gender	−.085	.035	.853	.918	.373–2.259
Race	−.104	.035	.851	.902	.306–2.657
Age	−.020	.824	.364	.980	.939–1.023
Socioeconomic Status					
Education		9.458	.024		
High School	−.746	.807	.369	.474	.093–2.416
Some College	−1.607	4.237	.040	.201	.043–.926
4 Years College and Beyond	−3.560	7.131	.008	.028	.002–.388
Employment	−.688	1.558	.212	.502	.170–1.481
Income	.004	1.160	.282	1.004	.997–1.010
Mental Health Severity					
BDI-II	.007	.087	.768	1.007	.961–1.055
CAPS	.006	.137	.711	1.006	.976–1.036
# of Anxiety/Depressive Comorbidities	.091	.230	.632	1.096	.754–1.591
Substance Use Severity					
ACQ	.002	.372	.542	.1.002	.995–1.010
Baseline days drinking	−.015	2.301	.129	.986	.967–1.004
Baseline days drugging	.019	5.048	.025	1.019	1.002–1.036
Step 2&3 (retain effects *p* < .2, *p* <.1)					
Socioeconomic Status					
Education		8.852	.031		
High School	−.752	.848	.357	.471	.095–2.337
Some College	−1.576	4.264	.039	.207	.046–.923
4 Years College and Beyond	−3.150	6.295	.012	.043	.004–.502
Substance Use Severity					
Baseline days drinking	−.013	1.979	.160	.987	.970–1.005

Predictor	B	Wald Statistic	p	OR	95% CI
Baseline days drugging	.019	5.300	.021	1.021	1.003–1.037
Step 4 (retain effects p < .05)					
Socioeconomic Status					
Education		8.852	.031		
High School	−.752	.848	.357	.471	.095–2.337
Some College	−1.576	4.264	.039	.207	.046–.923
4 Years College and Beyond	−3.150	6.295	.012	.043	.004–.502
Substance Use Severity					
Baseline days drugging	.015	4.043	.044	1.015	1.000–1.030

Table 3

Final Model of Predictors of Treatment Dropout

Predictor	B	Wald Statistic	p	OR	95% CI
Education		9.009	.029		
High School	−1.312	1.999	.157	.269	.044–1.660
Some College	−2.219	5.955	.015	.109	.018–.646
4 Years College and Beyond	−3.181	5.629	.018	.042	.003–.575
Baseline days drugging	0.016	3.379	.066	1.017	.999–1.035
ASI	0.050	4.153	.042	1.051	1.002–1.103
DERS	−.011	.637	.425	.989	.964–1.016